Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

On growth and flow: bacterial biofilms in porous media
WILLIAM DURHAM, ALBERTO LEOMBRUNI, OLIVIER TRANZER, ROMAN STOCKER, MIT — Bacterial biofilms often occur in porous media, where they play pivotal roles in medicine, industry and the environment. Though flow is ubiquitous in porous media, its effects on biofilm growth have been largely ignored. Using patterned microfluidic devices that simulate unconsolidated soil, we find that the structure of *Escherichia coli* biofilms undergoes a self-organization mediated by the interaction of growth and flow. Intriguingly, we find that biofilm productivity peaks at intermediate flow rates, when the biofilm is irrigated by a minimum number of preferential flow channels. At larger and smaller flow rates, fluid flows more uniformly through the matrix, but productivity drops due to removal by shear and reduced nutrient transport, respectively. These dynamics are correctly predicted by a simple network model. The observed tradeoff between growth and flow may have important consequences on biofilm-mediated processes such as biochemical cycling, antibiotic resistance and water filtration.

William Durham
MIT

Date submitted: 05 Aug 2011 Electronic form version 1.4